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## **Chapter 6.9 Space Systems and Test Safety**

### **6.9.1 Applicability of this chapter**

6.9.1.1 You are required to follow this chapter if you:

- a. Conduct or participate in testing activities at JSC or JSC field sites.
- b. Are involved in tests at other locations, foreign or domestic, including those with JSC equipment.

### **6.9.2 What this chapter covers**

This chapter covers the basic safety requirements and references for all tests conducted at JSC, and for tests conducted at other locations that involve JSC personnel or property or that are sponsored by JSC. This chapter applies to equipment being tested, test personnel, test facility interfaces to test equipment and personnel, test conduct, and test documents. Test hardware and operations shall also follow the requirements of other chapters in this Handbook. The term "testing," as used in this chapter, includes hazardous activities designed to accomplish training, demonstrations of test hardware or procedures, data acquisition, and hardware evaluation, qualification, or acceptance.

### **6.9.3 Exclusions from this chapter**

6.9.3.1 This chapter doesn't cover testing of institutional systems and equipment, diagnostic medical tests, or medical treatment procedures. (This exclusion doesn't apply to medical research testing.)

6.9.3.2 This chapter also excludes laboratory analysis, research, and experimentation that don't involve human subjects, flight hardware, prototype hardware, explosives, and oxygen-enriched atmospheres.

### **6.9.4 Requirements for test operations**

6.9.4.1 You shall keep the Safety and Test Operations Division informed of upcoming test activities by emailing test or support requests and schedules to the JSC-TSO-Mailbox and follow these requirements:

- a. For nonhazardous tests, you shall follow paragraphs 6.9.5 and 6.9.9 through 6.9.11 (operating procedures, test systems, and test team members) of this chapter and any other requirements from this chapter that you or the Safety and Test Operations Division decide to include. Also make test documentation available to the Safety and Test Operations Division on request.
- b. For hazardous tests, you shall follow all the requirements in this chapter that apply to your tests. You or the Safety and Test Operations Division may also decide to follow more stringent requirements.
- c. Include the applicable requirements of this chapter in any requirements you provide to test requestors.

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### 6.9.5 Test team members

The following personnel shall be present during each test as required below or in other sections of this chapter. These personnel may not be required to be present throughout the entire test. The testing organization's operating procedures or detailed test procedures (DTPs) specify when each member is to be present.

| <b><i>If you are the . . .</i></b>  | <b><i>Your duties are . . .</i></b>  | <b><i>Your certification requirements are . . .</i></b>   |
|---|--|---|
| Test Director (TD)  | To be the central authority and have overall responsibility for all aspects of the test.   | The responsibility of the testing organization  |
| Test Conductor (TC)<br>(Optional)   | Described in the testing organization's operating procedures or DTPs.  | The responsibility of the testing organization  |
| Test Safety Officer (TSO)   | To monitor all phases of test activities for certain human or especially hazardous tests, and to advise the TD of any activities deemed to be hazardous to JSC personnel or property.<br><br>To advise the Safety and Test Operations Division of any safety concerns that surface during the test.<br><br>To advise the Occupational Health Branch of any health concerns that surface during the test. | The responsibility of the Safety and Test Operations Division or the Occupational Health Branch |
| Medical Officer (MO) or Medical Representative (MR)   | To monitor the test conduct, provide medical assistance or opinions when necessary, and advise the TD any time the wellbeing of anyone involved in the test is being compromised.  | Defined by the Occupational Health Branch   |
| Facility or Test Support Personnel<br><br>Facility or test support personnel include all other personnel necessary to support a test, such as console operators, divers, test article support personnel, audiovisual personnel, or pressure suit engineers. | Listed in the testing organization's operating procedures, test plan, or DTPs.   | Specified in the testing organization's operating procedures, test plan, or DTPs.               |
| Test Subject (the human subjected to the test environment)  | Inform the TD if you feel that you may be in danger and desire to stop the test.   | Specified in the operating procedures, test plan, or DTPs.                                      |

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**6.9.6 Other requirements for test team members**

6.9.6.1 You shall observe the following additional requirements if you are the MO, MR or TSO:

- a. As the MO, you shall certify the fitness of test team personnel to do hazardous operations and of test subjects to participate before any hazardous testing begins.
- b. An MR shall monitor the medical conduct of tests under the following conditions unless excluded by, and as deemed necessary by, the Occupational Health Branch:
  - (1) Personnel in hypobaric, hyperbaric, and oxygen-enriched environments.
  - (2) Suited underwater neutral buoyancy operations.
  - (3) Ambient pressure suit operations using other than ambient air or where the suit pressure is greater than 8.8 psid (pounds per square inch differential).
- c. As the MR or TSO, you shall:
  - (1) Keep in communication with the TD at all times when your presence is required during the test.
  - (2) Review test documentation and participate in TRRs as required.
  - (3) Make sure that there is adequate and functional bioinstrumentation on each test subject.
- d. As a TSO, you shall also review test and safety documentation. You should attend test reviews as well.
- e. A TSO shall monitor the following tests:
  - (1) Personnel in hypobaric, hyperbaric, and oxygen-enriched environments
  - (2) Suited underwater neutral buoyancy operations
  - (3) Testing or training involving personnel at heights greater than 10 feet above the ground or on a platform
  - (4) Ambient pressure suit operations using other than ambient air or where the suit pressure is greater than 8.8 psid
  - (5) Other tests as recommended by ORI, URR, or TRR Board with concurrence of Safety and Test Operations Division

**6.9.7 Training and certification for test team members**

If you are a team member or support person, you shall be trained for your job as described in your operating procedures. Never fill a position without being trained or certified as required in the facility operating procedures. See Chapter 5.8, "Hazardous Operations: Safe Practices and Certification," of this Handbook for more requirements on certification. See Chapter 4.1, "Safety and Health Training" of this Handbook and JPR 8550.1, "JSC Environmental Compliance Procedural Requirements," for more requirements on training.

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**6.9.8 Operating procedures for testing**

As a testing organization, you shall have operating procedures that meet paragraph 10.2.6 of Chapter 10.2, "Safety and Health Requirements for Test, Vacuum, and Oxygen-enriched Facilities," of this Handbook. The operating procedures may contain more stringent requirements than those of this Handbook if you and the Safety and Test Operations Division believe they are required.

**6.9.9 Requirements for all test systems**

6.9.9.1 The following requirements apply to all test systems, both hazardous and nonhazardous. You can find additional requirements in other chapters of this Handbook:

- a. Test systems shall be designed and constructed so that a single-point failure, loss of utilities, fluctuation of utilities, or software command can't cause injury, property damage, or uncontrolled environmental spill, release, noncompliance, or nonconformance. Follow reliability and fault-tolerance requirements in paragraph 1.7 of NPR 8715.3, "NASA General Safety Program Requirements."
- b. Test systems used in oxygen-enriched, high-vacuum, or enclosed environments shall undergo materials scrutiny as defined by the testing organization's material control process.
- c. The test system's materials shall follow the material control requirements of Chapter 10.2 of this Handbook if the facility does not have a materials control process.
- d. Safety and environmental instrumentation shall be calibrated and certified before the test and as required by the test documentation or the testing organization's operating procedures.
- e. Test systems are approved for testing after the Test Readiness Review Board (TRRB), and after the Safety and Test Operations Division has signed the TRRB approval sheet, and all constraint action items are determined closed by the TRRB Chair (see paragraph 6.9.13).
- f. Software that interfaces with test systems shall meet NASA-STD-8719.13, "Software Safety."
- g. Make sure that no test team member can be exposed to hazardous materials used in the system.
- h. Clearly identify test controls in test and facility system drawings.

**6.9.10 Requirements for test systems involving human subjects**

6.9.10.1 In addition to the requirements above, human test systems shall:

- a. Meet the requirements in paragraph 3.14.7.2 in NPR 8715.3.
- b. Be designed for safe test termination and removal of test subjects if a power failure, fire, or other emergency occurs.

**6.9.11 Documentation requirements for tests**

6.9.11.1 You shall complete the following documentation as part of the test process. Complete everything but the test report and the mishap report before the test:

- a. The *test plan* is a top-level summary of the test. A test plan needs to be written for each new

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test. The test plan shall include the following as a minimum:

- (1) Test objectives.
  - (2) Safety, occupational health, and medical planning provisions and known medical issues.
  - (3) Test requirements.
  - (4) Special safety, occupational health, and environmental considerations for test.
  - (5) Other items, if required by the testing organization; test plans containing final DTPs (as described below) shall be approved in the same manner as a DTP document.
- b. The *DTP* describes the steps you will use to run the test. You need to write test procedures in a step-by-step sequential format. DTPs shall include the following as a minimum:
- (1) Operating procedures to accomplish the test.
  - (2) Measures to prevent mishaps.
  - (3) Emergency procedures to be taken in the event of systems failure or malfunction, such as fire, smoke, power outages, environmental spills and releases, and system failure.
  - (4) Test rules that define equipment and instrument limits, operating limits, off-nominal conditions, and operational situations that would require abort, hold, or proceed decisions for each test or checkout operation.
  - (5) The safety requirements, individual tasks, and personnel involved in hazardous operations.
  - (6) Special considerations and procedural steps that address specific hazards identified during the hazard analysis process; these, and steps containing actions critical to the protection of life or property, shall be flagged as safety-critical steps for easy identification by test team personnel.
- c. A *safety, health, and environmental assessment* that identifies the safety and health hazards associated with the test, the hazards' controls, and verification. Your operating procedures shall outline the assessment process and identify specific assessment subjects. The process should begin in the early phases of test planning and operations and should involve the Safety and Test Operations Division, the Environmental Office, and the Occupational Health Branch at every step. Eliminate, control, or close all hazards, or accept the risk before testing begins:
- (1) Your operating procedures state how you document the results of safety and health assessments. You shall update your assessments for changes to the hardware or operations.
  - (2) Chapter 2.3, "Hazard Analysis," of this Handbook describes system safety requirements and concepts. This includes an environmental impact assessment as described in JPR 8553.1, "JSC Environmental Management System Manual." You may use JSC 17773, "Instructions for Preparing Hazard Analysis for JSC Ground Operations," as a guideline for format or thought process for conducting safety assessments. Other information sources on safety assessments include MIL-STD-882, "System Safety Program Requirements," and Chapter 2 of NPR 8715.3, "NASA General Safety Program Requirements."
- d. If you prepare a *test report*, you should include any anomalies; safety, health, or environmental

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implications; and safety or health lessons learned. Send a copy of the report to the Safety and Test Operations Division, the Environmental Office, and the Occupational Health Branch. You may send lessons learned by means other than the report.

- e. You shall send in a *mishap report* for any incident causing injury, unapproved environmental spill or release, or unanticipated damage to the test article or test system that occurred as the result of the test. Submit a close call report if an incident occurred that could have caused injury, unapproved environmental spill or release, or unanticipated damage to the test article or test system. See Chapter 2.6, “Mishap and Incident Investigation,” of this Handbook for mishap reporting requirements.

**6.9.12 Requirements for certain test documents**

6.9.12.1 To allow for a proper review, you shall provide the minimum required test documentation (Test Hazard Analysis, Test Plan, Detailed Test Procedure) to Test Safety at least 48 hours before the TRR. Incomplete or late submissions will require rescheduling of the TRR (see subparagraph 6.9.15.b of this chapter for special exemptions). You shall also follow these rules:

- a. Each DTP containing safety-critical steps shall state that on its cover.
- b. Emergency procedures shall be immediately available to personnel at their duty stations unless it isn’t practical (such as divers).
- c. You shall have the Safety and Test Operations Division sign the Test Hazard Analysis. The Safety and Test Operations Division representative’s signature on the TRRB summary sheet shall indicate that other test documentation is approved for testing.

**6.9.13 Test readiness reviews (TRR)**

6.9.13.1 The following requirements apply to TRRs:

- a. You shall hold a TRR for each test involving human subjects and for other hazardous tests or series of tests. An annual TRR is acceptable for an undefined number of tests where the tests are similar, involve no significant changes to the hardware, are low risk (RAC 4 with the concurrence of the Safety and Test Operations Division), and are individually approved by the branch chief. A TRR determines:
  - (1) The readiness of the test facility and the test article
  - (2) The adequate completion of the safety, health, and environmental assessments
  - (3) The status and closure of key issues
  - (4) The test constraints
  - (5) The open items
  - (6) The qualification or certification of the test team
- b. The TRRB will be chaired by a management official or designee from the testing organization who is not personally involved with the test. The board membership will include:
  - (1) A Safety and Test Operations Division representative.

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- (2) An Occupational Health, Medical, Radiation Safety, or Industrial Hygiene representative (as appropriate) from the Occupational Health Branch.
  - (3) A Quality and Flight Equipment Division representative (for tests supported by the Quality and Flight Equipment Division ).
  - (4) An Environmental Office Representative (if appropriate).
  - (5) Other members who might be selected by the board chairman or the testing organization for their special knowledge.
- c. The TRRB members will sign a TRRB summary sheet to indicate their approval to proceed with your test pending closure of all constraint action items as determined by the TRRB Chair. A TRRB summary sheet generally will include:
- (1) The test objective
  - (2) A statement covering test article readiness
  - (3) The test schedule
  - (4) Approval of the staffing, operation, procedures, and safety, health, and environmental assessments
- d. A TRR shall assess hazards of all hardware and procedures involved in the test, to include:
- (1) Other procedures that are embedded in the test protocol, such as standard assessments
  - (2) The rationale for approval of previously approved test protocols to determine whether they are still valid
  - (3) Procedures that were developed for operational use and are being adopted for test use to determine whether they are appropriate for a test environment

**6.9.14 Other test reviews**

6.9.14.1 You shall have the following reviews unless they are indicated as “optional.”

- a. A *pre-test briefing* conducted by the TD or TC for each series of tests. The intent is to make sure that all test team members understand the test’s normal and emergency operations and all test hazards.
- b. *Pre-test checkout* operations, using approved test procedures. You need to conduct this before each series of tests to make sure that the test personnel will function effectively as a team and that the facility and test equipment are compatible. Your pre-test checkout operations shall include:
  - (1) Verification that all critical systems are functional.
  - (2) A “dry run” for complex tests, if practical, to exercise the facility and equipment for final compatibility and provide training and familiarization for the test team.
  - (3) Simulated emergency drills unique to the specific test.
- c. A *post-test debriefing* (optional) by the TC or TD for human or complex tests. The intent is to discuss the test results and any facility or test system anomalies that have occurred with the test team and subjects (if appropriate).

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**6.9.15 Repeat, real-time, and quick-turnaround tests**

6.9.15.1 You shall follow these requirements:

- a. You may repeat a test using previously approved configurations and procedures without another TRR as long as the test complies with the constraints of the original TRR and the paperwork has not changed. Modifications to the hardware or procedures will require a new TRR. Retests, modified procedures, and safety analyses shall be approved as described in your testing organization’s operating procedures.
- b. Real-time and quick-turnaround testing refers to testing that is required in real time to support a mission or pre-mission testing for a space mission. This testing is essential for timely start or safe continuation of the mission. For this type of testing, you may streamline the test process. As a minimum:
  - (1) You shall have test procedures and hold a TRR.
  - (2) You shall notify the Safety and Test Operations Division of such tests as soon as possible.
  - (3) A Safety and Test Operations Division representative shall be present for any procedure reviews, the TRR, and the test, if required.

**6.9.16 Requirements for all test operations**

6.9.16.1 You shall follow these requirements during any phase of test operations, both hazardous and nonhazardous, including buildup and teardown:

- a. Follow limits on work shifts for test team members and personnel supporting tests found in Chapter 5.8, “Hazardous Operations: Safe Practices and Certification,” of this Handbook.
- b. Keep test data records for at least 14 days after the test to help investigation and analysis of any mishaps or anomalous conditions. Safety may require keeping the records longer.
- c. Follow the approved procedures. Each Testing Organization shall have a form for Test Deviations.
- d. You shall document deviations from approved procedures on a deviation sheet. Deviation sheets require signature approved by the Safety and Test Operations Division if the deviation affects hazard closure or creates a new hazard.
- e. The TD and any appropriate engineers shall approve the deviation by signature along with the TSO and MR, if on station for the test. *Never make deviations from test rules during the test.*
- f. Make sure that the TD maintains voice contact with all critical test team members. Communication requirements shall be specified in your operating procedures, test plans, or test procedures.
- g. Follow these requirements as a TD:
  - (1) Redirect the test to a safe position or stop the test if advised to stop the test by a TSO. You may resume the test after you resolve the safety issues with the TSO.
  - (2) Follow the MR’s direction if the MR declares a medical emergency following established procedures.



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- (3) Give the TSO access to any area of the test facility whenever the TSO deems it necessary, provided the TSO is present, it doesn't create any additional hazard, and the TSO is certified for the environment after coordinating with the TD.

### **6.9.17 Requirements for tests involving human subjects**

6.9.17.1 In addition to the requirements in paragraphs 6.9.5 through 6.9.16, test operations involving human subjects shall meet the following:

- a. Keep in voice and visual contact with test subjects. Provide backup voice communications if feasible. Deliberate loss of voice or visual (but not both simultaneously) communications as part of a test is allowed if you document it in the approved test procedures.
- b. Equip rescue crews for tests with protective equipment suitable for the specific hazards of that test, such as breathing apparatus.
- c. Keep a hyperbaric treatment chamber on standby during the following test operations with human subjects:
  - (1) Pressure-suited operations in a vacuum or underwater environment.
  - (2) Ambient pressure suit operations where the suit pressure is greater than 8.8 psi above ambient.
- d. Have an MO certify the fitness of each test team member to test subjects doing hazardous operations before a test.
- e. Stop the test when a test subject requests that the test be discontinued.
- f. Use instruments on test subjects to monitor the critical physical parameters that the MO requires.
- g. Make sure appropriate emergency medical treatment is available, alerted, and on call.

### **6.9.18 Requirements for certain kinds of tests**

6.9.18.1 Some tests need to meet other requirements besides those addressed in this chapter because of the hazards or the nature of the tests. Tests not covered here or by other chapters of this Handbook should be coordinated with the Safety and Test Operations Division and the Occupational Health Branch at the earliest possible time to develop specific requirements in a timely manner. The following test operations shall follow these requirements:

- a. You shall observe the following additional requirements for *hypobaric tests* at pressures below normal atmospheric pressure:
  - (1) Follow JPD 8080.4 (current version), "Exposure to Reduced Atmospheric Pressures," for hypobaric tests involving human subjects.
  - (2) Monitor the oxygen level if the test isn't approved for an oxygen-enriched atmosphere. Stop the test if the atmosphere becomes oxygen-enriched.
  - (3) Maintain internal suit pressure at predetermined levels above ambient during pressure-suited operations.
  - (4) Take measures to prevent corona discharge.

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b. You shall observe the following additional requirements for *hyperbaric tests* at pressures above normal atmospheric pressure:

Note: This paragraph doesn't apply to hyperbaric medical treatment.

- (1) Monitor the oxygen level if the test isn't approved for an oxygen-enriched atmosphere. Stop the test if the atmosphere becomes oxygen-enriched.
- (2) Follow exposure times and decompression stops in the Navy Dive Tables or more stringent tables using equivalent pressure depth.
- (3) Never expose anyone who has been exposed to hyperbaric environments to any hypobaric conditions such as flying or altitude chambers for at least 12 hours after the hyperbaric exposure unless the subject has pre-breathed for a specified time according to JPR 1830.3.

c. For *underwater neutral buoyancy operations*, you shall meet and follow the following requirements and the requirements found in Chapter 6.6, "Underwater Operations Safety and Health," of this Handbook:

- (1) JSC neutral buoyancy operations are considered non-open-water operations that need to meet the requirements of Chapter 6.6 of this Handbook by the individual facility operating procedures.
- (2) You shall meet requirements for oxygen-enriched environments if other than ambient air oxygen percentage is used in the suit or if the differential suit pressure exceeds 8.8 psi.
- (3) All underwater personnel shall observe the restrictions on flying after diving of JPR 1830.3 (current version), "Limitations Applicable to Personnel Exposed to Diving."
- (4) Never require pressure-suited subjects to walk.

d. You shall use fall protection if personnel involved are at a height greater than 4 feet.

e. Physiological training shall follow the requirements for hypobaric tests listed above. A TSO needn't be present during all physiological training runs.

f. The requirements of subparagraph b above also apply to ambient *pressure suit operations*, except that suits using ambient air at pressures less than 8.8 psid aren't considered oxygen enriched. You shall follow procedures or lesson plans for testing or training, or demonstrations involving personnel in pressure suits at ambient conditions.

g. You shall develop handling procedures to protect high-cost and mission-critical *flight hardware*. Have new or modified procedures approved before handling the hardware.

h. You shall meet the following additional requirements for test systems flown on JSC *zero-gravity aircraft*:

- (1) Avoid hazardous materials, including high-pressure gases, toxic, corrosive, explosive, and flammable materials, where possible. If such materials are necessary, use proper containment. You may also require provisions for dumping and purging in flight to include minimizing or controlling impact to the environment.
- (2) Never use wet cell batteries with free electrolyte, such as lead acid car batteries. Battery circuits require analysis by battery experts and battery circuit safety protection to avoid shock, shorts, or overheating.

Verify correct version before use at

<http://server-mpo.arc.nasa.gov/Services/CDMSDocs/Centers/JSC/Home.tml>.

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- (3) The maximum total volume of inert gases or gases you may use on a flight is limited to one K-bottle (  $\approx 200 \text{ ft}^3$  @ 14.7 psi).
- (4) Airworthiness is determined by the JSC Aviation Safety Officer and the Aircraft Commander.
- (5) Follow the laser requirements in paragraph 3.15.7 of NPR 8715.3 if lasers are used.
- i. Tests on *air-bearing floors* involving moving articles pose a threat of injury to personnel involved in the test. You shall take appropriate measures to prevent the impact of moving objects with personnel.
- j. *Human research testing* shall follow NPD 7100.8, "Protection of Human Research Subjects," and 45 CFR 46, "Protection of Human Subjects."
- k. When you work in direct view of a bare (pressurized arc) lamp of a *solar simulator*, energized or not, you shall wear eye and skin protection unless it is locked and tagged in a de-energized state.
- l. Tests involving lasers shall have approval and monitoring from the JSC Laser Safety Officer. See Chapter 6.2 of this Handbook for more requirements.
- m. Tests involving biological materials shall have an assessment by the JSC Biosafety Review Board per JSC 63828 "Biosafety Review Board Operations and Requirements Document" to ensure the appropriate facility controls, PPE, and proper handling techniques are implemented. See Chapter 7.4 of this document for additional information on biosafety.

**6.9.19 Off-site tests**

6.9.19.1 JSC safety requirements still apply if you perform your testing off site at any foreign or domestic location. You shall follow the requirements in paragraph 6.9.20 for any one of the following:

- a. Off-site tests sponsored by JSC
- b. Off-site tests involving JSC personnel as test subjects
- c. Off-site tests involving JSC high-cost and mission-critical hardware

**6.9.20 Requirements for off-site tests**

6.9.20.1 If you or your organization sponsors an off-site test, you shall:

- a. Make sure, with help from the Safety and Test Operations Division, that the intent of these requirements is met either by the test site or by JSC. The JSC sponsor shall notify the Safety and Test Operations Division of the test at the earliest possible time. New facilities or new applications in existing facilities will require more scrutiny by JSC than established facilities and operations.
- b. Make sure that the safety requirements of the test site are followed. JSC may require that the applicable provisions of this chapter be followed in addition to the test site requirement(s).
- c. Provide the following additional data to the Safety and Test Operations Division as needed:
  - (1) Test site safety requirements and a safety point of contact from the testing organization.

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(2) Existing test facility documentation, such as drawings, specifications, hazard analyses, operating procedures, and emergency procedures necessary for an adequate review, if available.

- d. Make sure that a TD or equivalent will be in charge of the test at all times. The TD may be from JSC or the testing organization.
- e. Coordinate access by the Safety and Test Operations Division personnel to all test areas. The Safety and Test Operations Division shall:
  - (1) Review and concur on the test setup
  - (2) Coordinate JSC safety and medical monitoring with the Medical Operations Branch, as required

**6.9.21 Test readiness reviews and facility reviews for off-site tests**

6.9.21.1 The following requirements apply:

- a. If a TRR is held at JSC, it will be chaired by a JSC management official who is not personally involved with the test.
- b. A specially appointed JSC committee may review an off-site test facility and operations, and then grant approval for JSC participation via a letter for off-site facilities where testing with JSC personnel or hardware will occur on a regular basis. JSC may hold an operational readiness inspection for the facility and grant approval. JSC personnel and hardware may be involved in operations at approved facilities that follow the conditions of JSC approval. Modification of the facility or operating procedures will require JSC review before resuming operations with JSC personnel or hardware.

**6.9.22 Off-site users of JSC test facilities**

Personnel from other NASA centers, NASA contractors, and others often use JSC test facilities. Off-site users shall follow this chapter and the testing organization’s operating procedures.

**6.9.23 For more information on testing**

- a. 29 CFR 1910, “Occupational Safety and Health Standards, General Industry,” applicable subparts
- b. JPR 1710.13 (current version), “Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems”
- c. JPR 5322.1, “Contamination Control Requirements Manual”
- d. NFPA 70, “National Electric Code”
- e. Other appropriate standards, such as NFPA, American Society for Testing and Materials (ASTM), ANSI, etc.
- f. Individual JSC test facility operating procedures and safety plans
- g. Paragraph 3.14 of NPR 8715.3, “NASA General Safety Program Requirements”

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#### **6.9.24 Responsibilities for test safety**

- a. *Testing organizations* are responsible for:
  - (1) Ensuring compliance with facility safety, health, test, environmental, and operational requirements
  - (2) Maintaining personnel and facility documentation as required by this chapter and Chapter 10.4, “Facility Baseline Documentation Requirements for Hazardous or Critical Facilities,” of this Handbook
  - (3) Informing the Safety and Test Operations Division of planned test activities by email as per paragraph 6.9.4 of this chapter
  - (4) Informing directorate-level management of any additional risks before starting each new or nonroutine test or test series, where there is the potential during test operations for serious injury, loss of life, environmental spill or release, or loss of critical high-dollar-value hardware
  - (5) Making sure that potential environmental impacts have been considered before or during the TRR, and coordinating with the Environmental Office as needed
- b. *Test requesting organizations* are responsible for following test and facility safety, health, and environmental requirements and for preparing and submitting test documentation required by your operating procedures.
- c. The *Occupational Health Branch* is responsible for:
  - (1) Providing medical support, surveillance, and monitoring as required by paragraph 6.9.6 of this chapter
  - (2) Providing industrial hygiene support as required
  - (3) Making sure that appropriate emergency medical treatment facilities are available
- d. The *Safety and Test Operations Division* is responsible for:
  - (1) Making sure that a program is implemented to provide a safe and healthful workplace for test operations and test team personnel, and protecting government resources from loss, damage, and destruction
  - (2) Helping testing organizations, test requesting organizations, and resident Safety and Mission Assurance Offices, starting early in a project’s life cycle to identify potential safety issues and suggest mitigation plans
  - (3) Providing safety surveillance via a certified TSO as required by paragraph 6.9.6 of this chapter
  - (4) Reviewing and critiquing test equipment designs and documents to ensure appropriate safety requirements are included
  - (5) Providing concurrence on hazardous test operations
  - (6) Making sure that mishaps and anomalies are investigated, that results are reported to appropriate offices, and that proper controls are in place to prevent recurrence
  - (7) Providing Safety Technical Expertise to the Institutional Review Board
  - (8) Follow paragraph 1.14.2.b of NPR 8715.3 for offsite tests in paragraphs 6.9.19 – 6.9.21 of

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- e. *Resident Safety and Mission Assurance Offices* are responsible for:
  - (1) Coordinating with, and fulfilling the responsibilities of, the Safety and Test Operations Division at JSC remote sites
  - (2) Developing local test safety requirements and procedures that follow this chapter and Chapter 10.2 of this Handbook
- f. The *Institutional Review Board* is responsible for:
  - (1) Reviewing and approving all test plans where human research is involved per NPD 7100.8 (current version), "Protection of Human Research Subjects."
  - (2) Reviewing the safeguards of tests involving hazardous materials, where human test subjects or the test team may be exposed to those materials.